Reply to the Letter to the Editor

Reply to Bedi

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Keywords: CT angiography; Coronary arteries; Imaging

It is a pleasure to answer and explain the three requests mentioned in your letter to the editor [1]:

1. Our study [2] should describe a practical tool not only for diagnosis, but also for preoperative planning and decision making of coronary bypass grafting. We adopted and modified the classical segment model of the American Heart Association. This coronary tree model is mainly designed for diagnosis of any coronary disease from a cardiologist's perspective. We still used segments, but we differentiated these sections more from a cardiac-surgical perspective. Definitely, this is discussable; however, we believe that we assess invasive coronary angiographies (ICA) on different aspects compared with cardiologists. Of course, this modification is an individual classification from our clinic and can also be used in a classical way. However, it should demonstrate that it is timely and necessary to assess imaging in the cardiac-surgical perspective, which can differ from others because the goals are different.
2. Of course, we used existing protocols, neither had we re-programmed the software and/or developed new hardware, nor have we changed the contents of the protocols themselves. The modifications and new features were the application and composition of soft- and hardware, respectively, the different parts of the imaging tools and techniques. In addition, the definition of arrangements of responsibilities and manpower is important.

   Radiologists are responsible for optimal image quality for diagnostic, but cannot decide how many coronary bypass grafts are necessary and where they should be placed on the heart. This decision can only be done by cardiac surgeons. Because of that, they have to be able to use at least the basic steps at an original workstation to define the strategy themselves. This cannot be done based on images of radiologists because the purpose of these images is different. Especially, cardiac surgeons need three-dimensional (3D) images for overview of the topography and orientation to plan a potential surgical procedure, which is not possible in 2D images.
3. We believe it is important to 'keep it simple', so that transfer to clinical routine is easier to accomplish. The quantification of degree of stenosis was performed in the ICA in different views such as those commonly used in clinical routine. The diameter measurements in computed tomography (CT) were performed with an electronic calliper tool.

It is now the responsibility of cardiac surgeons to use CT as a diagnostic and planning tool instead of ICA. Our article should be an alert and encouragement to proceed. However, we also realised the problem of a certain inhibition threshold. Cardiac surgeons receive the prepared images by radiologists, which are definitely not optimal to prepare surgery. On the other hand, they do not have the time and practice to professionally use the workstation of a CT scanner. Our article illustrates one possibility to differentiate the work between radiologists and cardiac surgeons. Cardiac surgeons should be at least able to perform by themselves the steps which are described in this article. Otherwise, it will not be possible to transfer CT into clinical routine in the way it is desired and to replace ICA, not only for exclusion diagnostic.

References

[1] Singh Bedi H. Accuracy of dual source computed tomography coronary angiography: evaluation with a standardized protocol for cardiac surgeons. Eur J Cardiothorac Surg 2011;39:282.
[2] Plass A, Azemaj N, Scheffel H, Desbiolles L, Alkadhi H, Genoni M, Falk V, Grunenfelder J. Accuracy of dual source computed tomography coronary angiography: evaluation with a standardized protocol for cardiac surgeons. Eur J Cardiothorac Surg 2009;36:1011–7.

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Letter to the Editor

Re: Early failure of xenogenous de-cellularised pulmonary valve conduits: a word of caution!

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Keywords: RVOT; Right ventricle outflow tract; Pulmonary valve replacement; Xenograft; De-cellularised valve; Porcine; Tissue engineering

AutoTissue GmbH as the manufacturer of the Matrix P Plus® has some comments to the article of Rüffer et al. [1].

1. For production of the Matrix P Plus, only one patch is used and not three as stated in the 'Materials and Methods' section.
2. In the 'Surgical Technique' section, the authors described their positioning of the valve as close to the bifurcation. This is not in accordance with AutoTissue's recommendations. It is suggested to place the valve like a homograft, which means in a more or less orthotopic position.
3. Selection of valve sizes is very problematic in this article. Of the six explanted valves, one has been too small, three were too large and only two valves in this cohort had the appropriate size.
4. Five out of six patients had stenoses at the distal anastomosis. This has nothing to do with the tissue-engineered valve but with the residual glutaraldehyde in the equine patch, which envelopes the valve.
5. The authors described 'a' dissection like 'separation of the layers between the internal and external conduit membrane, which was still blood perfused during the

explantation'. This is very difficult to understand as blood between the valve and the patch will exit through the holes into the pericardial space. Hopefully, during surgery, the surgeons from Erlangen had not closed those prefabricated holes in the patch.

6. The histology shows the same pattern as with Contegra or Shellhigh valves, which means fibro-proliferative tissue at the level of the distal anastomosis. This is probably due to residual glutaraldehyde in the patch material.
7. The authors described that the outer patch remained cell-free, which is actually impossible. The outer patch is glutaraldehyde-fixed equine pericardium, which is not cell-free, only the valve within the patch is cell-free. The valve looked very nice at least in five out of the six cases, as authors wrote in the article.
8. The authors speculate about antigenicity. In fact, AutoTissue could show that the tissue is non-antigenic as there is no other antigenic material from porcine cell membranes left in the de-cellularised tissue [2].
9. The authors claim this to be the first publication regarding short- and midterm results of the Matrix P Plus®. The Matrix P Plus® came into the market in 2005; since then approximately 30 publications, original publications and abstracts, have been published in the surgical literature (references on file at AutoTissue).

AutoTissue is alert to the problems arising from the use of glutaraldehyde in its valved conduit and soon will bring out a conduit totally free from glutaraldehyde.

References

[1] Rüffer A, Purbojo A, Cicha I, Glöckner M, Potapov S, Dittrich S, Cesnjevar RA. Early failure of xenogenous de-cellularised pulmonary valve conduits — a word of caution! Eur J Cardiothorac Surg 2010;38:78—85.
[2] Erdbrügger W, Konertz W, Dohmen PM, Posner S, Ellerbrok H, Brodde OE, Robenek H, Modersohn D, Pruss A, Holinski S, Stein-Konertz M, Pauli G. Decellularized xenogenic heart valves reveal remodeling and growth potential in vivo. Tissue Eng 2006;12:2059—68.

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Reply to the Letter to the Editor

Reply to Erdbrügger and Stein-Konertz

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Keywords: RVOT; Right ventricle outflow tract; Pulmonary valve

First, I would like to thank Dr Erdbrügger for his kind invitation and his hospitality during my visit to AutoTissue and the Charité Cardiovascular Surgery Department in Berlin. I was able to observe the production of Matrix valves, including their implantation during a Ross procedure.

Regarding his letter to the editor [1] as a reply to our word of caution [2], I have a few comments:

(1) The single patch forming the conduit wall of the Matrix P plus has three segments: one enveloping the valve and two outer ones for proximal and distal anastomosis.
(2) Our operative technique used for pulmonary valve replacement in Ross procedures complies with the Charité technique. Moreover, there is no orthotopic positioning possible in patients without right ventricular outflow tract (RVOT), as in pulmonary atresia or congenitally corrected transposition of the great arteries with left ventricular insertion of the conduit.
(3) According to generally applied nomograms of cardiac structures in relation to body size [3], oversizing up to 0, 19, 9, 9, 9 and 8% (mean: 9 $\pm$ 6%) was present in the Matrix P plus failure group (n = 6). There was certainly no undersizing! Surprisingly, the group of patients without conduit failure had oversizing in a higher degree (mean: 15 $\pm$ 13%); however, this difference was statistically not significant (p = 0.65) [2].
(4 and 6) We agree to the comments.
(5) The prefabricated holes were not closed by surgery, but might have been blocked by the clotting system. Blood flow in the wrong compartment should not persist — if it does, it may be a problem of conduit design.
(7 and 8) The patch remained host-cell free. In all explanted conduits, the porcine pulmonary artery wall was covered by fibro-proliferative neo-intima containing inflammatory cells.
(9) Until now, upon searching PubMed, no original publications regarding clinical results with the Matrix P plus for pulmonary valve replacement have been found. We would be grateful to be supplied with the published mid- and long-term results from other institutions.

References

[1] Erdbrügger W, Stein-Konertz M. Letter to the editor. Re: early failure of xenogenous de-cellularized pulmonary valve conduits: a word of caution! Eur J Cardiothorac Surg 2011;39:283—4.
[2] Rüffer A, Purbojo A, Cicha I, Glöckler M, Potapov S, Dittrich S, Cesnjevar RA. Early failure of xenogenous de-cellularized pulmonary valve conduits: a word of caution! Eur J Cardiothorac Surg 2010;38:78—85.
[3] Daubeney PE, Blackstone EH, Weintraub RG, Slavik Z, Scanlon J, Webber SA. Relationship of the dimension of cardiac structures to body size: an echocardiographic study in normal infants and children. Cardiol Young 1999;9(4):402—10.

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